Baryons from twisted mass QCD

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Outline

Parameters

- Lattice: $24^3 \times 48$ $\beta = 3.9$ $\mu = 0.0085$
- We use Wuppertal smearing either at the source or at the sink or both
- The spatial links that enter the Wuppertal smearing function are APE smeared
- The spatial co-ordinates of the source are chosen randomly

Optimization of smearing

$q^{\text{smear}}(\mathbf{x},t) = \sum_{\mathbf{z}} F(\mathbf{x},\mathbf{z};U(t))q(\mathbf{z},t)$ with the gauge invariant smearing function constructed from the hopping matrix H: $F(\mathbf{x},\mathbf{z};U(t)) = (1+\alpha H)^n(\mathbf{x},\mathbf{z};U(t))$, where

$$H(\mathbf{x},\mathbf{z};U(t)) = \sum_{i=1}^{3}\left(U_i(\mathbf{x},t)\delta_{\mathbf{x},\mathbf{y}-i} + U_i^{\dagger}(\mathbf{x}-i,t)\delta_{\mathbf{x},\mathbf{y}+i}\right).$$

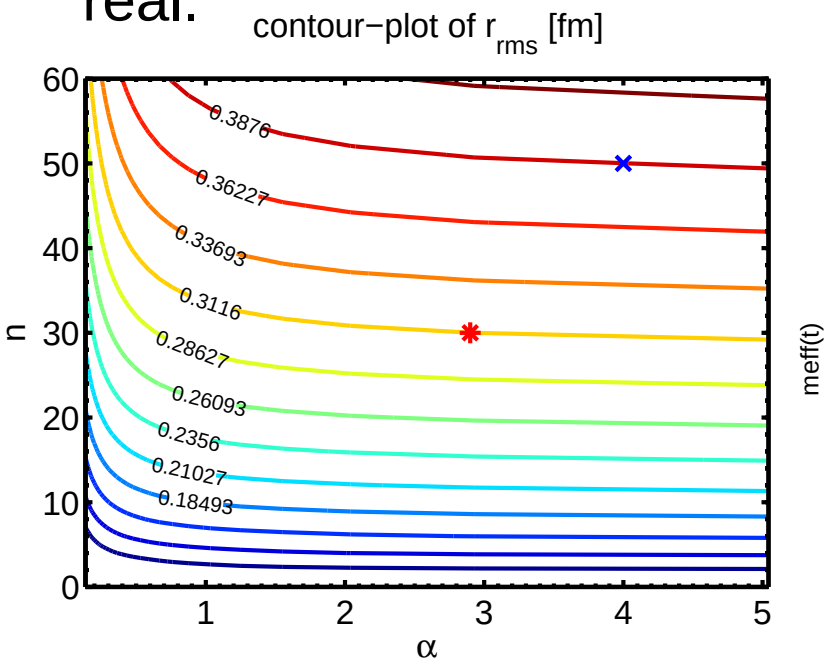
We vary the parameters α and n. We take as reasonable parameters those for which the r.m.s radius is 0.3-0.4 fm. We compare results for two cases, namely:

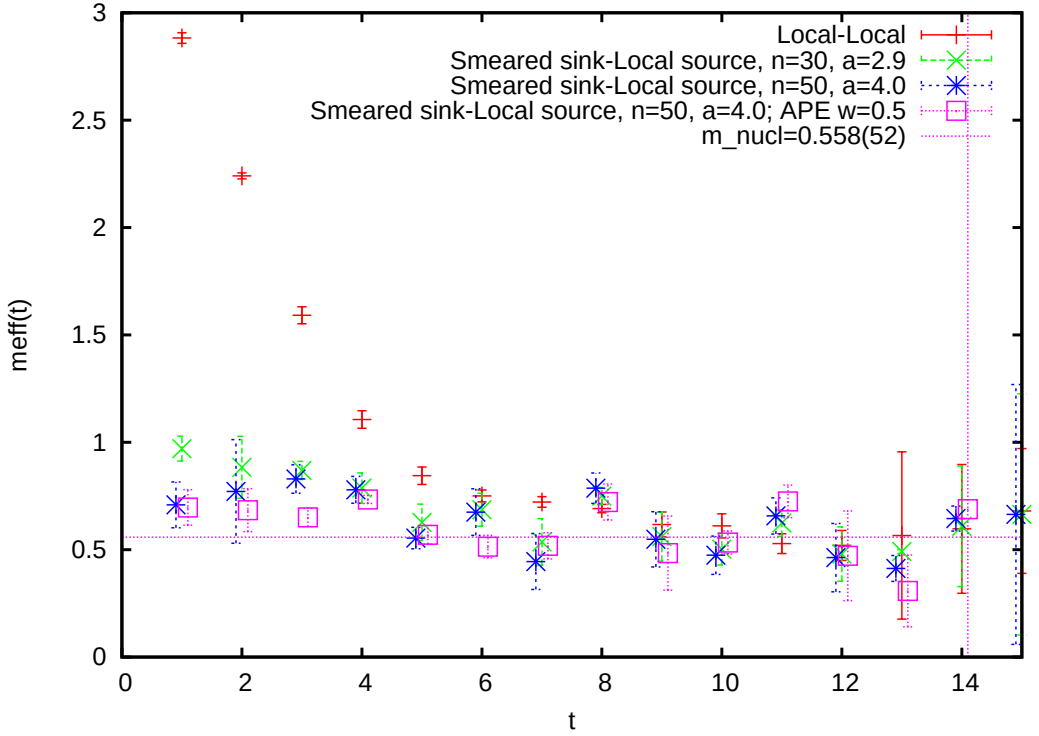
1. $\alpha = 2.9$ and $n = 30$ (asterisk on contour plot)
2. $\alpha = 4$ and $n = 50$ (cross on contour plot)

After determining the optimal parameters we tune APE smearing.

Optimization

The results are shown for the nucleon for 10 confs when smearing is applied to the sink. We averaged between proton and neutron since after averaging are degenerate due to the symmetry $\gamma_5 D_u^\dagger \gamma_5 = D_d$ and the fact that the correlators are real.





Results with the optimized smearing

Take $\alpha = 4$ and $n = 50$ with the optimal APE. We analysed 70-90 confs. We show local-smeared (LS) and smeared-smeared (SS) results for the nucleon, the Δ^+ and $\Delta^{++} \Longrightarrow \Delta^{++}$ degenerate to $\Delta^+ \rightarrow$ flavor breaking small!